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Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods

Forty-fifth session
Geneva, 23 June- 2 July 2014
Item 5 (e) of the provisional agenda
Electric storage systems: miscellaneous

Lithium batteries – appropriate hazard communication

Transmitted by the expert from the United Kingdom[1]

Introduction

1. Following discussion of ICAO's papers ST/SG/C.10/C.3/2013/49 and informal document INF 48 at the forty-fourth session, a lunchtime working group, chaired by the Vice-Chairman, met to consider the issue of appropriate hazard communication for lithium metal and ion batteries (UN numbers 3090, 3091, 3480 and 3481).

2. The conclusions of the working group were reported in INF 54, which set out three possible options for a way forward:

- Do not change the current regulation, but use existing rules to meet the needs of the air mode;
- Do not change Class 9, but define a specific hazard communication symbol that would be more appropriate for lithium batteries (and may be extended to other goods of Class 9);
- Adopt various divisions under Class 9, in accordance with the hazard characteristics of individual groups of articles.

3. The working group recommended a multistep approach starting with the concepts subsumed in option 2:

[1] In accordance with the programme of work of the Sub-Committee for 2013-2014 approved by the Committee at its sixth session (refer to ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

- Prepare a proposal for labels for lithium batteries that will characterise specific hazards under Class 9 in accordance with the type of goods (analogous to Class 7 labels);
- Evaluate the way the current marking system will integrate the proposals;
- After a definition of the content of the label, propose a design for the label while considering what kind of hazard characteristics would be represented;
- Co-ordinate this work with other work on including articles under Class 9.

4. This approach was endorsed by plenary, which also noted that ICAO's International Multidisciplinary Lithium Battery Transport Coordination (IMLBC) group would be holding a further meeting to discuss the carriage of lithium batteries in February 2014. That meeting subsequently resulted in four recommendations:

- Further restrict the carriage of lithium metal batteries on passenger aircraft;
- Develop permissions to transport batteries on passenger aircraft based on performance (reaction of the battery and performance of the packaging in a thermal runaway situation)
- Mitigate risks for transport on cargo aircraft based on the above performance criteria; and
- Adopt a multidisciplinary approach involving all stakeholders to advance cargo safety.

The first three of the ICAO recommendations are clearly mode specific. Work done by the Sub-Committee of experts on the Transport of Dangerous Goods could assist with the last.

5. The current paper therefore considers the specific issue of alerting participants in the transport chain to the hazards associated with lithium cells and batteries, in the context of a scheme which could be extended to other Class 9 substances and articles.

6. The subdivisions of substances and articles in Class 9 are set out at point 2.9.2 of the Model Regulations. Most are associated with an identified hazard - for instance, *substances which, on inhalation as fine dust, may endanger health*. Others simply name articles (*lithium batteries, lifesaving appliances*) without giving details of the type of the (sometimes multiple) dangers they may represent.

7. The existing lithium battery handling label used by air transport shows that:

(a) The package contains lithium batteries;

(b) The batteries are fragile/should be handled with care; and

(c) There is a flammability hazard if damaged.

Figure 1

ICAO's ILBTC meeting also identified fire as the major hazard.

8. Under the Model Regulations, requirements for the transport of lithium batteries are detailed at 2.9.4, and in P903/LP903. 2.9.4 indicates the possibility of 'violent rupture' and 'dangerous reverse current flow'. P903/LP903 refer to dangerous evolution of heat. Both note the need for measures to prevent short circuit.

9. Three Special Provisions in the Model Regulations are also relevant:

- SP 188, which sets out conditions for exemption, requires marks giving exactly the same information as the ICAO label (including a contact telephone number) on packages containing lithium cells or batteries. It refers to the possibility of a dangerous evolution of heat.
- Special Provision 376 deals with damaged or defective lithium batteries and refers to a number of possible hazards:

  Cells and batteries liable to rapidly disassemble, dangerously react, produce a flame or a dangerous evolution of heat or a dangerous emission of toxic, corrosive or flammable gases or vapours…

  It requires application of P908/LP904, which note possible hazards as the release of electrolyte (UN numbers 2796 and 2798, both Class 8 corrosives), dangerous evolution of heat and short circuit.
- Special Provision 377 deals with disposal or recycling and requires application of PP909, which also refers to dangerous evolution of heat and short circuit.

10. The Model Regulations therefore recognises the main hazard represented by lithium batteries as flammability (associated with short circuit), with a number of other possible risks, including explosivity, toxicity and corrosivity. None of these hazards are made apparent by the Class 9 label.

11. The working group suggested that a system for indicating Class 9 hazards might be developed by analogy with the Class 7 provisions. The four labels associated with Class 7 are illustrated below:

Label 7A Label 7B

Label 7C Label 7E

Figure 2

Except for 7E, these indicate different degrees of danger associated with a common hazard rather than disparate risks, and are not therefore directly analogous with the diverse range within Class 9. They also use English text, which is not ideal when transport may be across linguistic boundaries. However, as a system of alternative labels not linked to a separate Division or Class and as a design concept - general information in the top half of the label with more specific information in the lower half - these may well provide a way forward.

12. The most obvious alternative to this would be a two label system, the general Class 9 label with a variant of the ICAO handling label alongside, essentially the system currently in use for environmentally hazardous substances and elevated temperature substances:

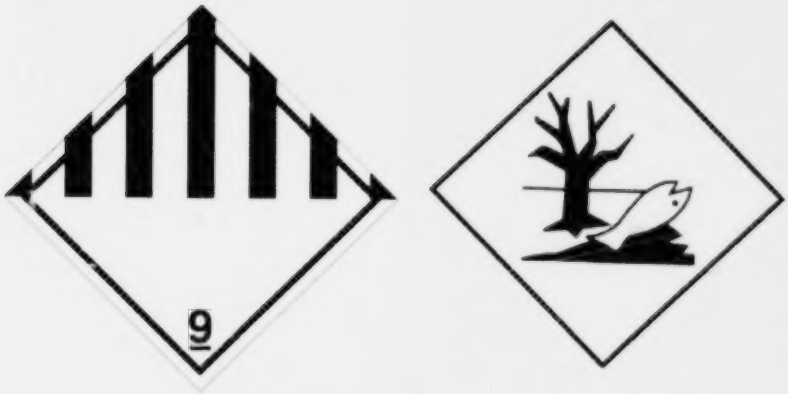


Figure 3

13. The four options for either a one or two label system would be to indicate that lithium batteries are being carried and:

(i) There is a flammability hazard;

(ii) There is a flammability hazard if they are damaged;

(iii) There are multiple associated hazards; or

(iv) There are multiple hazards if they are damaged.

14. The first option is obviously the closest to current practice under the Model Regulations, but would mean that participants in the supply chain would only be aware of subsidiary risks through training. (According to how the presence of batteries was indicated, the contents of the consignment might also only be obvious after training.)

15. The general introduction to the Model Regulations specifies that:

The labelling system is based on the classification of dangerous goods and was established with the following aims in mind:

(a) To make dangerous goods easily recognisable from a distance by the general appearance (symbol, colour and shape) of the labels they bear;

(b) To provide, by means of colours on the labels, a useful first guide for handling, stowage and segregation.

Bearing these points in mind, some possible labels/placards are detailed below.

16. With a fire hazard, suitable combination formats would include:

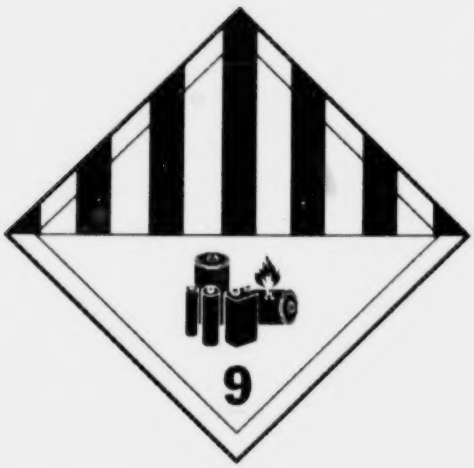


Figure 4

Figure 5

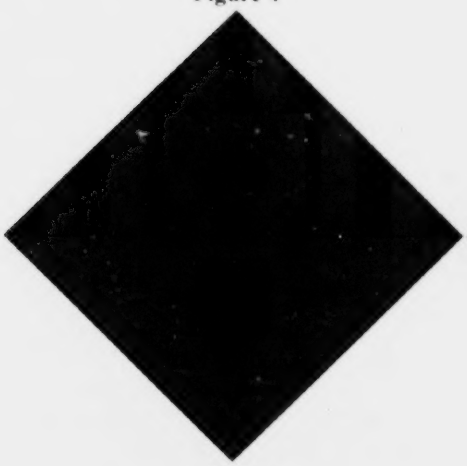


Figure 6

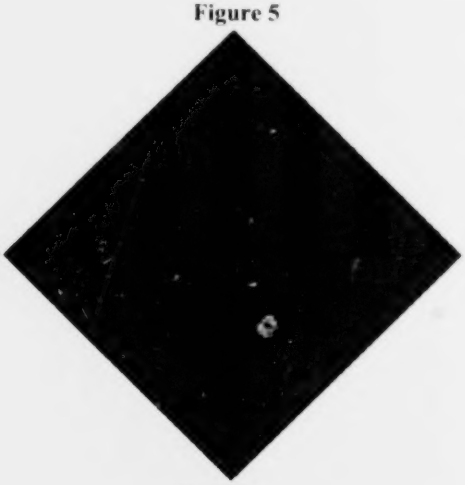


Figure 7

(removing damaged element)
or, as an example of a two label system:

Figure 8

It would also be possible to incorporate other hazards, such as corrosivity or explosivity in a pictogram:

Figure 9

Figure 10

17. Finally, a different approach could also be adopted by using a strip of images with no language content, to be displayed adjacent to the Class 9 label, as below:

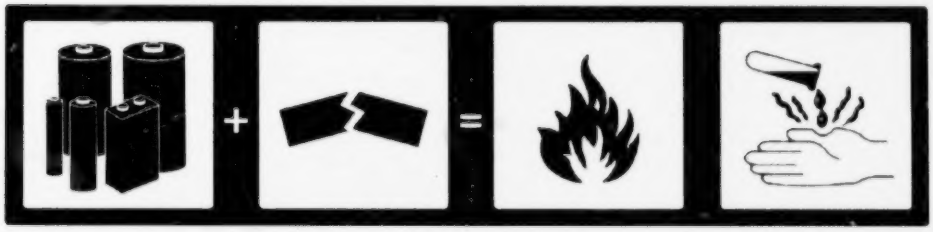


Figure.11

18. If a new, combination label were adopted, industry would require a transition period in order to use all or most existing stocks, although this would have lower cost implications in the long run. A secondary label could be introduced more quickly. Indeed, in a first phase and perhaps for longer, either display option could be deemed acceptable. As the suggested pictograms include the same hazard warning elements as the ICAO label and are essentially self-explanatory, only minimal extra training would be required.

19. If the general concept is accepted, it would be possible to extend this to at least some other groups of substances/articles in Class 9. This might be considered as a work item for the next biennium. Labels could be in line with any of the models shown above, e.g.:

Figure 12 – EHS

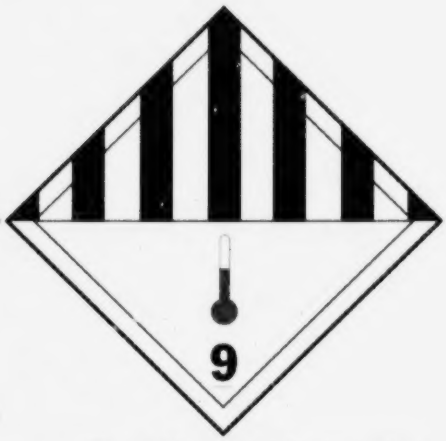


Figure 13 – elevated temperature

Proposals

20. In order to assist the Sub-Committee to reach conclusions, textual amendments to apply the options identified are set out below.

Option 1

(Labels indicating that lithium batteries are being transported and have a flammability hazard, but not associating the hazard with damage – no exemptions)

(i) In the Dangerous Goods List in Chapter 3.2, add Special Provision XXX against the following UN numbers in column (6): 3090, 3091, 3480 and 3481

(ii) At 3.3.1, Special Provision 188, add the following:

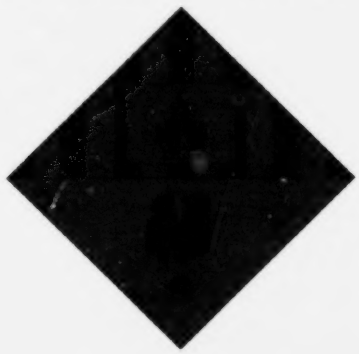
- Delete (f) (ii) and renumber points (iii) and (iv)
- Add the following:

"(j) The class 9 label No. 9L is displayed, see 5.2.2.2.2."

(iii) At 3.3.1, add a new Special Provision XXX, to read:

"The class 9 label to be used is No. 9L, see 5.2.2.2.2."

(iv) At 5.2.2.2.2, under CLASS 9, add the following:



(No.9L)

Symbol (seven vertical black stripes in upper half with flame symbol); black or white

Background: red;

Symbol (batteries): black or white on red"

Option 2

(Labels indicating that lithium batteries are being transported and have a flammability or possibly multiple hazards, associated with damage to the batteries – no exemptions)

(i) In the Dangerous Goods List in Chapter 3.2, add Special Provision XXX against the following UN numbers in column (6): 3090, 3091, 3480 and 3481

(ii) At 3.3.1, Special Provision188:

- delete (f) (ii) and renumber points (iii) and (iv)
- add the following:

"(j) The class 9 label No. 9L is displayed, see 5.2.2.2.2."

(iii) At 3.3.1, add a new Special Provision XXX, to read:

"The class 9 label to be used is No. 9L, see 5.2.2.2.2."

(iv) At 5.2.2.2.2, under CLASS 9 , add the following:

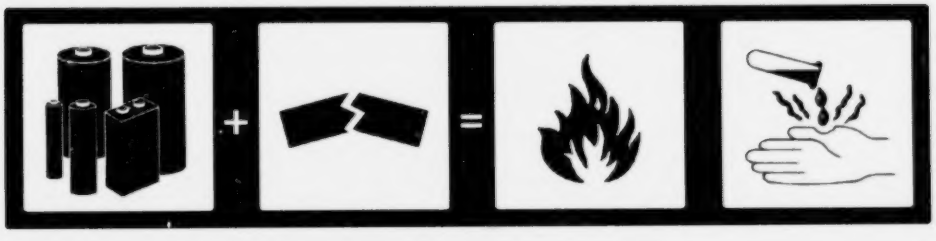
"(No.9L)

Symbol (seven vertical black stripes in upper half); black or white

Background: red;

Symbol (batteries with flame (and explosion)): black or white on red"

or



(No.9L)

Symbol (batteries plus broken battery equals flammability, explosive, corrosive hazards) black on white"

Option 3

(As Options 1 or 2, but as a separate mark to appear alongside the Class 9 label.)

(i) At 3.3.1, Special Provision188:

- delete (f) (ii) and renumber points (iii) and (iv)
- add the following:

"(j) The lithium battery mark is displayed, see 5.2.1.6.3."

ii) Rename 5.2.1.6 as Special marking provisions for goods of Class 9

iii) Insert a new 5.2.1.6.1, 2 and 3 as follows (in order to keep the Class 9 entries in the same order as at 2.9.2.):

"5.2.1.6.1 Packages containing lithium batteries meeting the criteria of 2.9.4 shall be durably marked with the lithium battery hazard mark shown in 5.2.1.6.3.

5.2.1.6.2 The lithium battery mark shall be located adjacent to the marks required by the appropriate provisions of 5.2.1.1. The requirements of 5.2.1.2 and 5.2.1.4 shall be met.

5.2.1.6.3 The lithium battery mark shall be as shown in Figure 5.2.2.

Figure 5.2.2

The mark shall be in the form of a square set at an angle of 45 degrees (diamond shaped.) The symbol (group of batteries, one damaged, with flame) shall be black on white or suitable contrasting background. The dimensions shall be 100mm x 100mm and the minimum width of the line forming the diamond shall be 2mm. If the size of the package so requires, the dimensions/line thickness may be reduced, provided the marking remains clearly visible. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

***NOTE**: The labelling provisions of 5.2.2 apply in addition to any requirement for packages to bear the lithium battery mark.* "

(iv) Renumber the existing paragraphs from current 5.2.1.6.1 to the end of the Chapter.

(v) Renumber Figure 5.2.2 and the corresponding references to 'Figure 5XX'

(vi) At 5.3.2.3 replace "*Environmentally hazardous substance mark*" with "*Lithium battery mark*"

(vii) Replace existing 5.3.2.3.1 and 2 with the following:

"5.3.2.3.1 A cargo transport unit containing lithium batteries meeting the criteria of 2.9.4 (UN Numbers 3090, 3091, 3480 and 3481) shall be marked on at least two opposing sides of the unit and in any case in such a position as may be seen by all those involved in the loading or unloading processes, with the lithium battery mark to be affixed in accordance with the provisions of 5.3.1.1.4 for placards.

5.3.2.3.2 The lithium battery mark for cargo transport units shall be as described in 5.2.1.6.3 and Figure 5.2.2, except that the minimum dimensions shall be 250mm x 250mm."

(viii) Renumber existing 5.3.2.3. – 5.3.2.3.2 as 5.3.2.4 -5.3.2.4.2.